

AD-A167 031

UNIT COST ANALYSIS: EXECUTIVE BRIEFING(U) RAND CORP
SANTA MONICA CA J F SCHANK ET AL. MAR 86 R-3210/1-RA
MDA903-85-C-0030

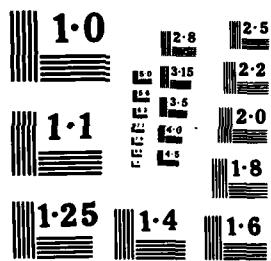
1/1

UNCLASSIFIED

F/G 14/1

ML

END
negative
6-B6
17



AD-A167 031

(12)

Unit Cost Analysis

Executive Briefing

John F. Schank, Susan J. Bodilly,
Richard Y. Pei

DTIC
SELECTED
APR 29 1986
S E D

This document has been approved
for public release and sale. Its
distribution is unlimited.

Rand

300 28 228

The research described in this report was sponsored by the Office of the Assistant Secretary of Defense/Reserve Affairs under Contract MDA903-85-C-0030.

Library of Congress Cataloging in Publication Data

Schank, J.

Unit cost analysis : executive briefing.

"March 1986."

Bibliography: p.

"R-3210/1-RA."

1. United States—Armed Forces—Appropriations and expenditures. 2. United States—Armed Forces—Reserves—Costs. 3. United States—National Guard—Costs. I. Bodilly, Susan J. II. Pei, R. Y. III. United States. Office of the Assistant Secretary of Defense (Reserve Affairs) IV. Rand Corporation. V. Title.

UA23.S32 1986 338.4'735537'0973 85-9463

ISBN 0-8330-0650-9

The Rand Publication Series: The Report is the principal publication documenting and transmitting Rand's major research findings and final research results. The Rand Note reports other outputs of sponsored research for general distribution. Publications of The Rand Corporation do not necessarily reflect the opinions or policies of the sponsors of Rand research.

Published by The Rand Corporation

12

R-3210/1-RA

Unit Cost Analysis

Executive Briefing

**John F. Schank, Susan J. Bodilly,
Richard Y. Pei**

March 1986

**Prepared for the
Office of the Assistant Secretary of Defense/
Reserve Affairs**



S [] D
APR 29 1986
E

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

PREFACE

The Rand Corporation has developed a methodology for estimating the annual operating and support costs for comparably equipped combat units in the Active and Reserve components of the military services, and has applied this methodology in a number of case studies. This methodology is based on methods used in the military services' own manuals with some modifications and interpretations. The research was conducted in Rand's Defense Manpower Research Center for the Office of the Assistant Secretary of Defense/Reserve Affairs under Contract MDA903-85-C-0030.

This report documents an executive briefing of the costing methodology and the case-study results. The briefing summarizes the analysis described in a companion report: *Unit Cost Analysis: Annual Recurring Operating and Support Cost Methodology*, R-3210-RA, May 1985. It should be of interest to those concerned with the annual costs of Active and Reserve Force units and with force mix cost issues.

Accession For	
NTIS	GRA&I
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special



SUMMARY

The Total Force concept, enunciated in 1969, emphasizes the crucial complementarity of the Active and Reserve components of our armed forces. Decisions concerning changes in the relative Reserve/Active contributions should depend on a thorough understanding of the budget and national security consequences. In order to acquire an initial understanding of one ingredient of potential budget implications of force mix decisions, we have developed a cost methodology and applied it to a number of cases across the services.

Our analysis was directed at the comparable annual operating and support costs of similar Active and Reserve Force units. We first developed a general model for estimating annual recurring unit costs and then refined and tailored the general model to the individual services by analyzing the annual cost of various combat units. In this report, we present the results for three representative units: a 16-aircraft C-130E squadron, a mechanized infantry battalion, and a FF1052 class frigate.

The cost methodology estimates the annual recurring incremental costs of unit personnel, peacetime equipment operations, and peacetime base support. The separate elements of total unit cost are estimated by combining personnel and equipment factors in simple linear equations. These factors are derived from the current force structure and, therefore, the resulting model cost estimates are appropriate for small changes to the current force but may underestimate the cost due to large changes in the mix of Active and Reserve Force units.

We note that the recurring costs necessarily omit the one-time costs of creating or dismantling Active or Reserve units. Also, for a complete analysis of Reserve/Active Force mix decisions, the costing information we provide must, at a minimum, be joined with assessments of the combat capability provided by alternative force mixes.

The model deals solely with annual unit O&S costs at proposed peacetime operating tempos. Although programmed operating tempos are designed to maintain unit proficiency, there is no guarantee that comparably equipped units have comparable capability.¹ Thus, no conclusions about the desirability of transferring equipment or missions

¹Many factors will affect capability and must be considered in making comparisons. Factors include the mission of the units; the experience base of the units; the available diversity of training opportunities including unit level training, division or wing level training, special exercises, sophisticated training equipment, and extreme weather training.

from one component to another can be drawn from examining O&S costs alone.

The cost differences between similar Active and Reserve units vary greatly depending on the specific type of unit. If the Reserve combat units are labor intensive, and if there are few full-time personnel, then their annual operating and support costs generally are substantially less than those of comparable Active combat units. For capital-intensive combat units, if the variable equipment costs exceed the fixed equipment costs, and if the peacetime activity rates of the Reserve unit are less than those of the Active unit, then the equipment-related annual costs will be significantly less for the Reserve unit.

Specific findings include the following:

- The Air National Guard (ANG) C-130E unit has annual operating and support costs equal to approximately 72 percent of a similar Active unit. For both Active and Reserves, the total annual unit costs are approximately half equipment-related and half personnel-related. The ANG personnel-related costs are 75 percent of the Active unit personnel costs, and the ANG equipment-related costs are 67 percent of the Active's equipment-related costs.
- In the case of Army combat battalions, the low number of full-time personnel in the National Guard unit results in a ratio of Guard to Active personnel costs of 15 percent, reflecting the fact that part-time Reserve component personnel drill only about 15 percent of the time during the year. Overall, the National Guard mechanized infantry battalion has annual operating and support costs equal to approximately 21 percent of an Active unit.
- For the Navy FF1052 class frigates, 90 percent of the manning of an Active unit is full-time while the Reserve unit has significant numbers of both full- and part-time personnel. This results in personnel costs for the Reserve frigate of about two-thirds of those of its Active counterpart. The annual costs of ship operations are very similar for the Active and Reserve FF1052s. The total annual cost of the Reserve frigate is very close to that of the Active unit, with a ratio of about 86 percent.

The accuracy of the cost estimates depends on the quality of the available data, which varies across the services and the different categories of cost factors. In general, the Air Force has published cost information for various categories of equipment costs, the Navy has not published some equipment cost factors but can provide such data

upon request, and the Army does not have adequate equipment cost data and has difficulty in developing cost factors on a unit basis. Personnel cost factors were generally available from published documents for each of the services.

With the costing methodology developed under this research, the necessary tools are now available to estimate the annual recurring costs of specific types of units. However, it is premature to generalize.

Additional research in a number of areas is required to provide the complete cost analysis needed for force mix and policy decisions on the structure and operations of Reserve force units.

- Nonrecurring activation and deactivation costs.
- Effects on the marginal costs of personnel resulting from different force mix strategies.
- The cost effects of alternative training strategies, maintenance policies, and peacetime operating tempos, intended to maintain capabilities in the presence of changes in the Active/Reserve balance.

ACKNOWLEDGMENTS

Mr. J. Anthony English, Director of Analysis, Office of the Assistant Secretary/Reserve Affairs (OASD/RA), provided support, encouragement, and guidance throughout this research effort. We are grateful to individuals in the comptroller, personnel, manpower, training, logistics, and operations offices in the Active, Reserve, and Guard branches of each of the military services for providing necessary background information and data. In addition, several agencies outside the services offered very helpful guidance. These include study groups at the Congressional Budget Office, the General Accounting Office, and the Center for Naval Analyses. A great deal of time, attention, and critical expertise was provided by the DoD Office of the Actuary.

Within Rand, Jonathan Arnold and Corazon Francisco devoted many hours to computerizing the models and managing the data bases. James Hosek, Gregory Hildebrandt, David Grissmer, and many others at Rand provided thoughtful direction. John Birkler reviewed the draft report and offered valuable suggestions to improve and clarify the presentation. Finally, Luetta Pope painstakingly helped prepare the manuscript and gave us excellent general research support.

CONTENTS

PREFACE	iii
SUMMARY	v
ACKNOWLEDGMENTS	ix
INTRODUCTION AND MOTIVATION	1
STUDY OBJECTIVES	3
BRIEFING OUTLINE	4
STUDY APPROACH	5
Study Ground Rules	6
Cost Elements	7
Data Availability	9
CASE STUDIES	11
Case Study Results Show Variances Between and Within Services	12
C-130E Unit Costs	13
Mechanized Infantry Unit Costs	15
FF1052 Unit Costs	16
Military Retirement Chart	18
FORCE WIDE ANALYSIS	20
Operating Tempo and Relative Weight	20
Equipment Maintenance Needs Drive Full-Time Manning Requirements	22
Relationship Between Equipment Operations Requirements and Reserve/Active Personnel Cost Ratio	23
Summary Remarks	24
Other Issues	25
REFERENCES	27

INTRODUCTION AND MOTIVATION

- **Increased interest in Reserve forces**
 - Congressional focus on force mix
 - Creation of OASD/RA
- **Budgetary impact of force mix decisions**
 - Need for better data base
 - Need for consistent costing methodologies for total force

The Total Force concept, first stated in 1969, was a milestone in the military's approach to force mix decisions. Balancing defense objectives against budgetary constraints, the Total Force concept provides for national security needs by emphasizing, among other things, the complementarity of the Active and the Reserve components of our armed forces.

The design of an effective total force requires understanding potential tradeoffs and cost implications, supported by an adequate data base and thorough analysis. To this end, a viable and consistent costing methodology is indispensable. However, different agencies have used different approaches, methodologies, and data or emphasized different research questions when considering the cost implications of force mix decisions. In contrast, the present research applies a single cost methodology across the services and their components for input into budget considerations.

This executive briefing describes our analysis of comparable annual operating and support costs of similar units in the Active and Reserve components of the various military services.

Although this analysis is a major ingredient in Active/Reserve comparisons, it does not consider all the potential costs involved. The cost of a change in the Active/Reserve balance depends on how that change is implemented. For example, in the transfer of equipment from the Active to the Reserve forces, military capabilities may be held constant or changed, equipment may be transferred without a complete transfer of missions, or new facilities may be required. Also, the activities of seemingly unrelated units may be affected. Each of these factors can

imply different unit manning and activity levels, changed flows through formal and on-the-job training, and significant start-up costs. These costs and other capability issues must be included in any Active/Reserve assessments.

The complete research and study results, summarized in this document, appear in *Unit Cost Analysis: Annual Recurring Operating and Support Cost Methodology*, R-3210-RA (Ref. 1).

STUDY OBJECTIVES

- **Estimate annual operating and support costs for case study units in the Active and Reserve components of the force**
- **Develop tools and models to provide force-wide cost estimates for policy decisions**

This investigation of Active and Reserve Force costs has two objectives: (1) to estimate the annual operating and support (O&S) costs for selected case studies in the Active, Reserve, and National Guard components of the Air Force, Army, and Navy, and (2) to develop the analytical tools, models, and data bases necessary to provide inputs to the economic considerations of force mix decisions. The research has resulted in unit annual operating and support cost estimating models and companion data bases for the Air Force, Army, and Navy.

BRIEFING OUTLINE

- **Analytical approach**
- **Case study results**
- **Force wide analysis**

We will first describe the analytical approach for addressing comparable nonrecurring O&S costs of Active and Reserve Force units. We will next show the results of a number of the case study analyses. Drawing on the case study results, we will describe the general factors that affect the annual costs of Active and Reserve Force units as well as those factors that contribute to the cost differentials between the two components.

STUDY APPROACH

- **Identify significant costs and develop costing framework that applies to all services and components**
- **Use existing models and data bases whenever possible**
- **Use case studies to derive cost factors and refine framework**
- **Identify and analyze force-wide cost drivers for use in policy decisions**

We first defined a costing framework that can be applied to all services and components. This framework encompasses the appropriate elements of annual operating cost, including costs incurred by one component of the force in support of another component.

We then examined the models and data factors that are currently used for unit cost estimates by the military services. Typically, these models were developed for Active units. They seldom contain Reserve unit data and require some modification before they can be applied to Reserve costing. Whenever possible, we used published and accepted personnel and equipment cost factors that are easily updated.

We carried out case studies of Air Force, Army, and Navy Active and Reserve units. In developing the case study cost estimates, we conducted interviews with the comptroller, personnel, and training organizations of the Active and Reserve components.

The case study analyses allowed us to identify those factors that dominate the annual operating and support costs of units and are responsible for the differences between the costs of Active and Reserve Force units. Analysis of these cost drivers provides necessary inputs into the cost aspects of force mix decisions.

STUDY GROUND RULES

- **Active and Reserve units have similar**
 - Personnel
 - Equipment
 - Wartime missions
- **Annual O&S costs do not include**
 - Force overhead costs
 - Unit conversion costs
 - Base opening costs
- **Costs are based on a 'snapshot' of the current force structure and personnel flows**
- **Costs are estimated for notional units**
- **Costs are in FY83 dollars**
- **Capability issues are not addressed**

The analysis addresses the comparable annual operating and support costs of similar units in the Active and Reserve components of the force. Similar units are defined as having the same general wartime mission, the same types and numbers of unit equipment, and similar numbers of unit personnel. The personnel levels are based on the unit authorization statements, and the equipment-related costs are based on the programmed peacetime operating levels. Program factors are used instead of actual manning levels and actual operating tempos to overcome any effects of yearly fluctuations caused by budget constraints or crises.

The estimates include the average, recurring costs of unit personnel, equipment operations, and peacetime base support. The cost estimates do not include force-wide administration costs, the fixed-base operating support personnel costs, or the costs of unit conversions. The cost estimates, therefore, represent the steady-state annual costs associated with having an incremental unit in the force structure stationed at an existing installation. Personnel-related costs are based on the current force structure and the flow of personnel into, out of, and between the Active and Reserve components.

The cost estimates are based on notional, or typical, units. Specific units may have slightly higher or lower costs due to site-specific operating conditions or to personnel recruiting problems. However, the various personnel strengths and cost factors average these differences across units.

The cost factors and the resulting cost estimates are expressed in FY83 dollars.

It is important to note that the analysis deals solely with cost issues; no assumptions are made about the capability of the Active or Reserve units. The greater continuity and experience levels of Reserve personnel may give them a capability advantage over Active units in some areas. On the other hand, the part-time nature of the peacetime Reserves may put them at a disadvantage when compared to the full-time status of Active units. Furthermore, Reserve units may not have the full range of wartime capabilities of a comparable Active unit; for example, Reserve Air Force tactical aircraft squadrons do not have nuclear ordnance missions.

Similar manning and equipping should not be interpreted as implying comparable capability. Many factors affect capability and must be considered in making comparisons. Factors include the mission of the units, the experience base of the units, and the available diversity of training opportunities.

COST ELEMENTS

- **Unit and support personnel**
 - Pay and allowances
 - Replacement training
 - Acquisition
 - Retirement
 - Other
- **Equipment operations**
 - Petroleum, oil, lubricants (POL)
 - Spare parts
 - Higher level maintenance
 - Training ordnance
 - Other

The annual unit O&S cost estimates are broken into two main categories—personnel costs and equipment costs. The various cost elements within these two categories are estimated by applying the appropriate personnel and equipment cost factors in simple linear equations.

Personnel costs are estimated for the various categories of people associated with the unit or the peacetime support of the unit. Personnel are segregated into officers, enlisted, and civilians. For both Active and Reserve units, military personnel are further separated into full-time and part-time members of the unit.

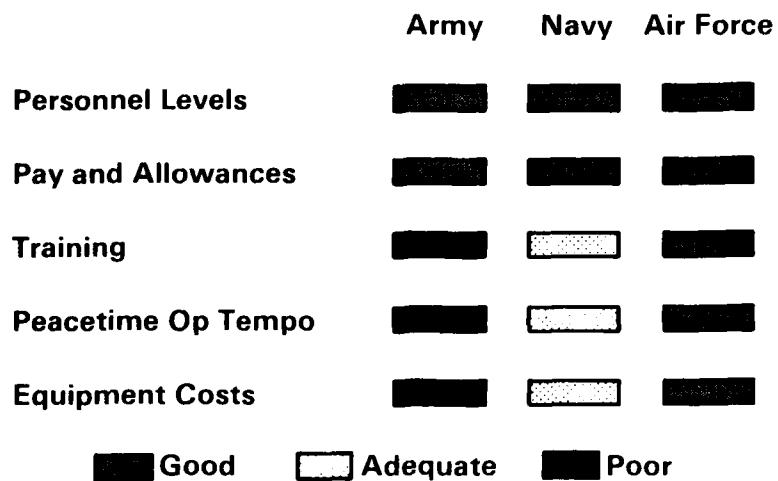
The Reserve components, although basically a part-time force in peacetime, have some full-time members. These full-time Reserve personnel are responsible for the continuing unit administration, support, and peacetime equipment maintenance.

Personnel are further distinguished by broad functional areas to account for different pay and training costs. For aviation units, military personnel are separated into pilots, other aircrew, and ground personnel because of the extra flight pay and the large training cost for aircrew members.

Personnel cost elements include pay and allowances, the cost to acquire and train personnel to replace those members of the unit that leave during the course of a year, and other personnel-related costs such as medical, bonuses, travel, and a pro rata share of base support costs including utilities, rentals, communications, and data processing.

Equipment-related costs have a fixed and a variable component. Certain elements of the equipment costs in the unit may be fixed, whereas other elements vary with the peacetime operating tempo.

DATA AVAILABILITY



The accuracy of the cost estimates is directly related to the quality of the personnel and equipment cost factors, or to the availability of the data necessary to develop these factors. We found that the quality of available data varied across the services and across the categories of factors.

Unit personnel strengths and the data needed to develop the per capita pay and allowance factors are readily available for the Active and Reserves in all three services. Each service has a document that specifies the numbers and types of personnel authorized for a unit. Reserve personnel organizations were able to provide information on the full-time members of Reserve and Guard units. The pay and allowance factors were developed from the detailed information in the service component's Personnel Budget Justifications.

The availability of the data necessary to estimate replacement training costs varied across the three services. The Air Force has published turnover rates and training costs for various categories of personnel (Ref. 2). The Navy has not published training cost factors, but can provide some training cost data from their personnel and training groups. The Army has no adequate published factors and, because of the wide variety of personnel associated with Army units, has difficulty in developing training cost factors on a unit basis. Improvements in the Force Cost Information System (FCIS), currently being imple-

mented by the Army Comptroller's Cost Analysis Division, will strengthen the training cost data published in the Army Force Planning Cost Handbook (Ref. 3) and should help alleviate the deficiencies in Army training cost data.

Equipment-related cost estimates are primarily based on the peacetime activity levels of the unit equipment and the various fixed and variable equipment cost factors. Again, the Air Force has published factors for peacetime equipment operations and for the various elements of cost (Ref. 2). These factors, however, apply primarily to Active units. The Navy can provide authorized activity levels for ships and aircraft and cost factors can be developed from the Visibility and Management of Operating and Support Cost (VAMOSC) data collection system.

Equipment costs for Army units are difficult to estimate because of the large number of equipment items associated with a unit and because of the wide year-to-year and unit-to-unit variances in peacetime unit training. There are no specified operating levels for Army equipment (other than aircraft) and there are currently no centralized data systems adequate to develop average equipment cost factors. Because of the shortfalls in data necessary to develop the equipment costs associated with Army units, the case studies of Army battalions relied on data collected from specific units to estimate equipment-related costs. The improvements to the FCIS and current efforts by the Army's Training Directorate (DAMO-TR) to develop a battalion level training model should greatly improve the ability to estimate equipment-related costs for Army units.

CASE STUDIES

- Air Force
 - ~ F-4D (18, 24 PAA)
 - ⇒ ~ C-130E (8, 16 PAA)
- Army
 - ⇒ ~ Mechanized infantry
 - ~ Armor (M60)
 - ~ Field artillery
 - ~ Combat engineer
- Navy
 - ~ F-4S (12 PAA)
 - ⇒ ~ FF1052 frigate

Using cost estimating models and data bases developed for the three services, a number of case study units were analyzed. The case studies included fighter and transport aircraft squadrons in the Air Force, combat-level battalions in the Army, and both an aircraft squadron and a ship in the Navy. Combat support units were not studied.

These units were selected because they exist in both the Active and Reserve component force structure and because they represent a range of capital and labor intensity for combat units. For the Army case studies, costs for Active and Reserve units were estimated at both Authorized Levels of Organization 1 and 2. The Authorized Levels of Organization relate to different degrees of unit readiness and strength, with ALO 1 representing the earliest deploying units.

For this summary, we present annual O&S cost estimates for a 16-aircraft C-130E squadron, a mechanized infantry battalion, and a FF1052 class frigate. These specific cases are representative of the overall results of the units studied and show the wide variances in cost differentials between Active and Reserve units.

CASE STUDY RESULTS SHOW VARIANCES BETWEEN AND WITHIN SERVICES

- **Service-unique policies on personnel, training and maintenance affect unit costs**
- **Differences between Active and Reserve unit costs vary with:**
 - Peacetime mission operating requirements
 - Part-time/full-time personnel mix
 - Ratio of fixed to variable equipment costs
 - Replacement training characteristics

Each of the three services has its own unique policies on recruiting prior-service personnel for Reserve units, training personnel and units, and providing maintenance and logistics support to unit equipment. These service-unique policies affect both total unit costs and the individual elements that comprise total annual costs. Because of these differences, it is difficult, and possibly misleading, to compare the cost of similar units in the military services.

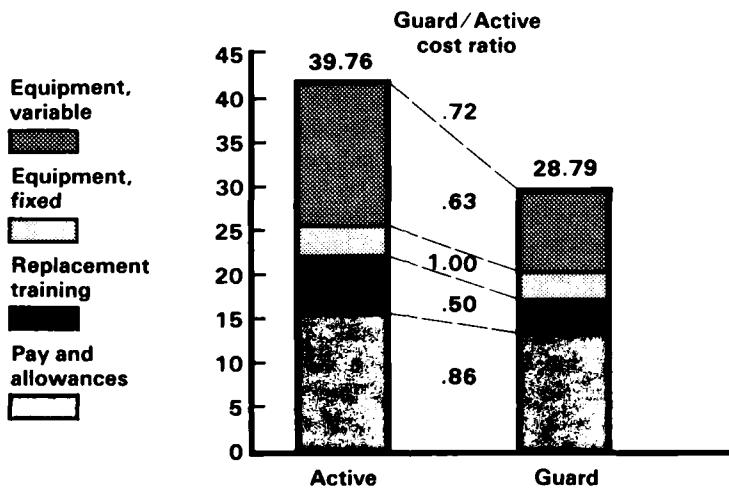
The case studies show that differences in annual recurring costs between Active and Reserve Force units within a given service will vary depending on a number of factors. The Reserve component units included in the case study analyses have lower equipment operating levels than their Active counterparts. The lower flying hours or steaming days for the Reserve units result in lower equipment-related costs. The difference between equipment costs for Active and Reserve units is also a function of the ratio of fixed to variable equipment costs. If the fixed equipment costs are high compared to variable equipment costs, the lower peacetime activity levels of Reserve Force units will not significantly lower the total equipment-related costs of Reserve units.

The case study results also show that the mix of full-time and part-time personnel in Reserve units affects the cost differences between similar Active and Reserve units. If there are large numbers of full-time personnel, the personnel-related costs of Reserve units approach the personnel-related costs of comparable Active units. When the Reserve unit has relatively few full-time members, there are large

differences between Active and Reserve unit personnel costs. Also, if Reserve units recruit mostly prior-service personnel, training costs are reduced. Lower Reserve unit costs due to training fewer non-prior-service personnel appear most important for aviation units because of the high cost of training pilots and other aircrew members.

The variances in the costs between similar Active and Reserve units are highlighted in the three case studies in the following charts.

C-130E UNIT COSTS (PAA 16) (MILLIONS FY83 DOLLARS)



Our first case study shows the comparable costs of 16-aircraft C-130E units in the Air Force. The Active squadron is stationed on an Active Air Force base and the Air National Guard (ANG) unit is situated on a commercial airfield. The costs are broken into four main categories. The bottom segment of each bar represents personnel pay and allowances and other personnel-related costs. The second segment represents the costs for the acquisition and training of replacement personnel. The personnel costs in these lower two segments of the bars include costs for both unit and base operating support personnel. The upper two segments of each bar show equipment-related costs—

first the fixed equipment costs and on top the equipment costs that vary with peacetime activity levels. The ratio of Reserve cost to Active cost for each segment and for the total annual unit cost is indicated by the values between the Active and Guard bars.

The smaller peacetime flying programs and the part-time status of many of the unit personnel result in lower annual costs for the ANG C-130 unit as compared to the similar Active unit.

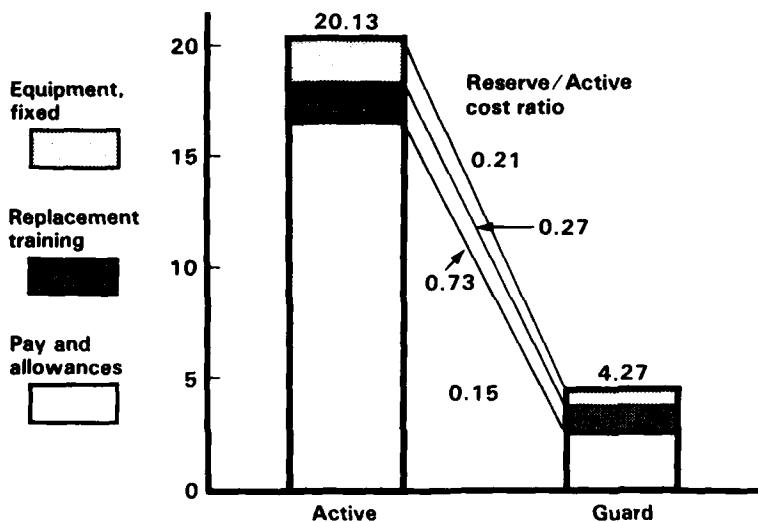
The Air National Guard C-130E unit has annual operating and support costs equal to approximately 72 percent of the similar Active unit. The ANG personnel-related costs are 75 percent of the Active unit personnel costs and the ANG equipment-related costs are 67 percent of the Active's equipment-related costs.

Most of the fixed costs per aircraft and the variable cost per flying hour were assumed to be equal for the Active and ANG units. The only difference in equipment cost factors is a lower POL cost per flying hour for ANG aircraft, which contributes to the lower ANG equipment-related costs. However, lower equipment cost for the ANG unit is due primarily to the fewer programmed flying hours in peacetime (462 flying hours per aircraft per year for the ANG versus 720 for the Active unit).

A widely held belief is that Reserve units, because of their part-time operations in peacetime, have much lower personnel-related costs than Active units. However, the results for the C-130E case study show that the personnel pay and allowances for the ANG unit are not that different from those of the Active unit. The high ANG unit personnel cost is mainly due to the full-time members of the ANG unit—for example, 239 of the 625 unit personnel are full-time Air Technicians (ATs). These ATs receive both their civilian and military reservist wages. Most of these full-time personnel are in maintenance and provide the continuous maintenance required for peacetime aircraft operations.

The replacement training cost for the ANG unit is approximately half the cost for the Active unit because of higher retention rates in the National Guard and the prior-service gains of the Reserve components. In aviation units, the high cost of training aircrew members makes the recruiting of prior-service individuals a very cost-effective strategy.

MECHANIZED INFANTRY UNIT COSTS (ALO 2) (MILLIONS FY83 DOLLARS)



The second case study shows the cost estimates for a mechanized infantry battalion in the Active Army and in the Army National Guard. These units are costed at ALO 2 (90 percent manned and equipped for wartime requirements). Where the C-130E represents a capital-intensive combat unit, the mechanized infantry is a good example of the Active and Reserve component cost differences for a labor-intensive combat unit.

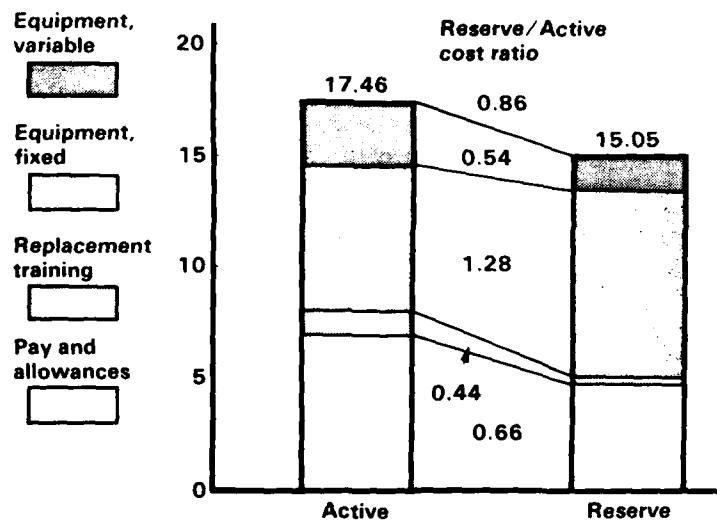
The elements of annual cost are presented in a manner similar to the C-130E costs with the exception of the representation of equipment-related costs. Because we had no equipment activity levels or cost factors for Army units, fixed and variable equipment costs could not be separated. The equipment costs displayed in the chart are based on data collected from Active Army units at Fort Hood and units of the Texas National Guard. Similar data were collected for Active units at Fort Stewart and from the Georgia National Guard.

The mechanized infantry case study shows a very different picture from the C-130E case study. First, for Army units, equipment-related costs are a very small part of total unit costs. Therefore, the uncertainty of the unit equipment cost estimates should not greatly influence the total unit cost estimates.

The second main difference between the mechanized infantry and the C-130E case studies is the low personnel-related costs of the Army National Guard unit compared to the Active. Both the Active and National Guard units have the same number of personnel (as specified in the unit TO&E). The National Guard unit, however, is truly a part-time force in peacetime, having relatively few full-time personnel assigned (19 out of 874). The low number of full-time personnel results in a ratio of Guard to Active personnel cost of 15 percent, reflecting the fact that part-time Reserve component personnel drill about 15 percent of the year.

Overall, the National Guard mechanized infantry battalion has annual O&S costs equal to approximately 21 percent of an Active unit. This ratio was generally the same across all the units investigated in the Army. For labor-intensive combat units, such as those in the Army, Reserve unit costs are significantly less than Active unit costs.

FF1052 UNIT COSTS (MILLIONS FY83 DOLLARS)



The last case study, a FF1052 class frigate in the Active and Reserve Navy, shows the cost estimates for another capital-intensive type of unit. The illustration follows the same format as the previous two charts.

The capital intensity of the ship is reflected in the high equipment-related costs. Although the Reserve ship has a peacetime activity level (steaming days) less than half that of the Active ship, the equipment-related cost for the Reserve unit is actually slightly greater than the equipment cost of the Active ship—for two reasons. First, the equipment-related costs are dominated by the fixed costs associated with scheduled ship overhauls. These fixed overhaul costs are assumed by the Navy to be equal for Active and Reserve ships. Second, the part-time status of many of the personnel on the Reserve ship forces a greater reliance on intermediate level maintenance. A portion of the ship maintenance performed by the crew of the Active ship must be deferred by a Reserve ship to the more expensive intermediate level. This transfer of work to a higher level of maintenance results in higher equipment-related costs for the Reserve ship when compared to the Active.

The Active frigate has mostly full-time, active duty personnel (90 percent of the crew are full-time); the Reserve frigate has large numbers of both full-time and part-time personnel (53 percent of the Reserve crew are full-time). Also, the TAR (Training and Administration of Reserves) members of the Reserve unit have higher personnel pay and allowances than does the average sailor on an Active ship. The resulting personnel cost for the Reserve ship is about two-thirds the personnel cost of the Active FF1052 class frigate.

The total annual cost of the Reserve frigate is very similar to the annual cost of the Active frigate, with the Reserve ship having costs approximately 86 percent of those of the Active ship. This high ratio again reflects the high fixed equipment costs and Reserve reliance on full-time manning.

**INCLUSION OF MILITARY RETIREMENT HAS
ONLY A MODERATE EFFECT ON
RESERVE/ACTIVE COST RATIO**

	<u>C-130E</u>	<u>Infantry</u>	<u>FF1052</u>
No retirement	.72	.21	.86
Current single accrual	.67	.21	.85
Proposed dual accrual	.65	.18	.82

The personnel cost estimates shown for the case studies did not include any costs for military personnel retirement. The FY85 Personnel Budget Justifications include a retirement cost calculated at 50.7 percent of base pay. This factor represents the current Normal Cost Percentage (NCP) developed by the DoD Office of the Actuary with an Aggregated Entry-Age Normal model (Ref. 4). The Actuary's model estimates the uniform percentage of basic pay that must be set aside so that future retirement benefits can be fully funded. Applying this single accrual factor to the Active and Reserve personnel costs of the case studies increases the cost differences and, therefore, reduces the cost ratio between Active and Reserve units very slightly.

Because the single accrual system does not capture the differences between the Active and Reserve retirement systems or between Active and Reserve personnel retention, retirement cost additives were also calculated on the basis of a dual accrual system. For dual accrual, the DoD Actuary calculated separate NCPs for the Active and Reserve retirement systems. Using these separate values—8.1 percent for the Reserves and 52.2 percent for the Active—increases the cost differences between Active and Reserve units, although the cost differences change only slightly.

Including military personnel retirement costs, especially on a dual accrual basis, increases the cost advantage of Reserve component units. The magnitude of the increase in the cost differences is highly depen-

dent on the many factors and assumptions used to estimate the future costs of military retirement and requires further analysis before definitive results can be postulated.

FORCE WIDE ANALYSIS

OPERATING TEMPO AND RELATIVE WEIGHT OF FIXED COSTS DRIVE RESERVE/ACTIVE EQUIPMENT COST DIFFERENCES

	Air Force: C-130E		Navy: FF1052	
	Active	Guard	Active	Reserve
Operating tempo (fly or steam hours per year)	720	462	3022	1116
Millions dollars (FY83)				
Variable costs	15.0	9.3	2.8	1.5
Fixed costs	3.1	3.1	6.6	8.4
Total equipment costs	18.1	12.4	9.4	9.9

Reserve component units typically have lower peacetime equipment operating levels than comparable Active units, generally because of the greater experience of many Reserve personnel, especially aircrew members. Other factors that may reduce Reserve equipment operating levels below those of a comparable Active unit include a lower demand for maturing personnel for higher level management positions, fewer peacetime mission requirements (e.g., Air Force peacetime transportation requirements), and fewer wartime operational capabilities (e.g., Reserve tactical fighter squadrons do not have nuclear strike missions). The lower Reserve activity rates reduce the variable portion of equipment-related costs.

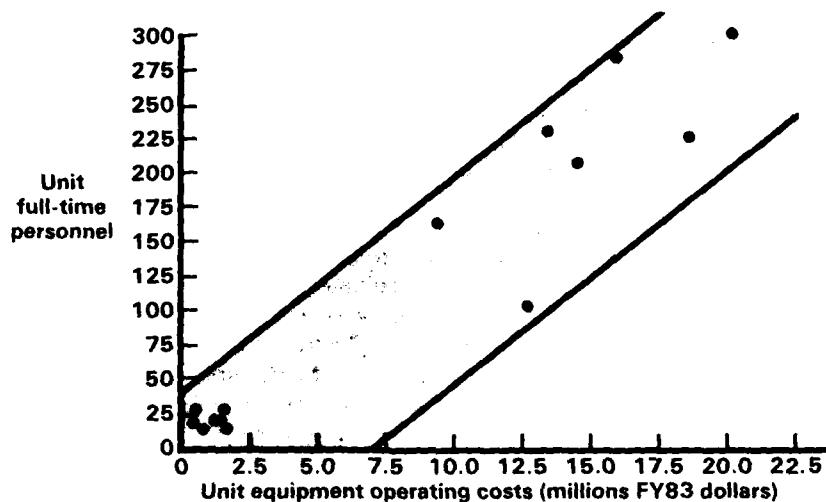
Operating tempos and the fixed and variable equipment costs for the C-130E unit in the Air Force and the FF1052 ship in the Navy are displayed above. The lower activity levels for Reserve units, either flying hours per year for aircraft or steaming hours per year for ships, result in the lower variable equipment costs. The overall effect of reduced Reserve operating times on total equipment costs varies, however, for the two types of units.

For the C-130E squadron, the variable part of equipment cost is significantly larger than the fixed portion. The lower Guard activity level, therefore, significantly affects total equipment-related costs. The ratio of Guard to Active equipment cost is similar to the ratio of operating tempos.

For the FF1052 frigate, fixed costs dominate the total unit equipment costs (for the FF1052, Reserve fixed costs are greater than the Active fixed costs because of the increased reliance on intermediate level maintenance). Therefore, the reduced operating times have little effect on the total equipment cost of the Reserve ship. The ratio of Reserve to Active total equipment costs is driven by the fixed costs rather than the variable costs.

Equipment costs are a major portion of the total annual O&S costs for ships and aviation units. When equipment costs have a large fixed component, the lower peacetime activity rates of Reserve component units will have less of an effect on the difference between Active and Reserve unit cost than if the fixed equipment costs are small compared to the variable costs. This observation suggests that the potential cost savings of placing a unit in the Reserve rather than in the Active component will be greater if the unit equipment costs are predominantly from peacetime operations and if the peacetime activity level of the Reserve component unit is less than the operating levels of the Active unit.

EQUIPMENT MAINTENANCE NEEDS DRIVE FULL-TIME MANNING REQUIREMENTS

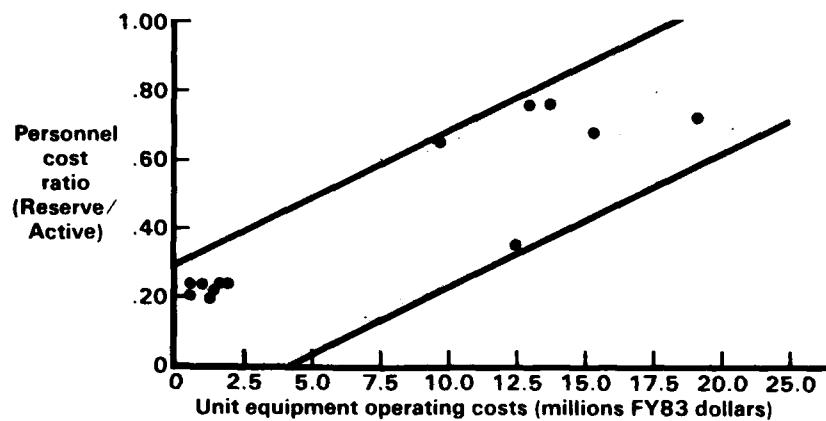


Proponents of transferring Active units to the Reserve components may argue that Reserve units are much less expensive because of reduced personnel costs. This argument centers around the perception that, since Reserves are a part-time force in peacetime with a Reservist serving about 15 percent of the year, Reserve unit personnel costs are approximately 15 percent of the personnel cost of a similar Active unit. The case study analyses of the ship and aviation units suggest that Reserve unit personnel costs can be much higher than this 15 percent standard. For capital-intensive units, the Reserve unit personnel costs ranged from 50 to 85 percent of the personnel costs of the comparable Active unit.

The larger than expected personnel cost for the Reserve ship and aviation units is due primarily to their substantial complement of full-time members. Full-time cadre provide the continuing administration, support, and equipment maintenance required in peacetime. One proxy for equipment maintenance is the annual cost of operating unit equipment. The above chart displays the numbers of full-time personnel and equipment operating costs for the case study units. The Army units, which have relatively low equipment operating costs, have few

full-time personnel assigned to the Reserve component units. The Air Force and Navy units, however, have both large equipment operating costs and large numbers of full-time unit personnel.

RELATIONSHIP BETWEEN EQUIPMENT OPERATIONS REQUIREMENTS AND RESERVE/ACTIVE PERSONNEL COST RATIO



This chart gives an alternative view of the relationship between personnel costs and equipment costs. The ratio of Reserve unit personnel to Active unit personnel cost versus Reserve equipment operating costs is plotted for the case study units. Again, as the equipment operating costs increase, the personnel-related costs of the Reserve unit approach the personnel costs of the Active unit.

The correlation between full-time personnel and equipment operating costs contributes to the higher ratios of Reserve to Active cost for capital-intensive units. Also, the introduction of "new weapon technology" into Reserve units may result in larger numbers of full-time personnel, thereby increasing Reserve component unit costs. This effect is already being seen with the introduction of the M-1 tank and the TACFIRE electronics system in the Army Guard and Reserves and the FFG7 class of frigates in the Navy Reserve.

SUMMARY REMARKS

- **Relative to Active unit costs,**
 - Reserve unit personnel costs are lower when
 - units are labor intensive
 - equipment maintenance requires few full-time personnel
 - Reserve unit equipment costs are lower when
 - fixed equipment costs are low
 - Reserve peacetime activity levels are less than the Active's
- **Variations found in unit costs mean force-mix decisions must be based on specific unit cost and capability analysis**

The results of the analysis can be summarized by addressing the Reserve unit personnel and equipment cost advantages evident in the case studies. If combat units are labor-intensive (personnel), and if there are few full-time personnel associated with Reserve units, then the annual O&S costs of Reserve units will tend to be significantly less than the annual costs of comparable Active units. For capital-intensive combat units, if the fixed portion of equipment costs is smaller than the variable portion and if the peacetime activity rates of the Reserve unit are lower than the activity rates of the Active unit, then the equipment-related annual costs of Reserve units will tend to be significantly less than those of Active units.

Overall, the cost differences between similar Active and Reserve units varied greatly for the different types of units analyzed, suggesting that the cost analysis of force-mix decisions should be based on analysis at the unit level. The models and data bases developed by this research provide some of the tools necessary to estimate the annual costs of specific types of units.

OTHER ISSUES

- **Nonrecurring costs**
- **Effects of changes in the force mix**
- **Effects of changes in personnel policies**
- **Effects of new training strategies**
- **Weapons modernization costs**

Criteria other than cost are relevant to force-mix decisions. Capability, force size constraints, and the required rotation base must also enter into the final determination of what kind and how many units should be placed in the various components of the force.

Though a necessary step, our cost analysis is not a complete consideration of the economic factors affecting force-mix decisions. Other relevant costs such as the nonrecurring costs of unit transfers, the change in the marginal cost of personnel or equipment due to changes in the force mix, and the cost of the transfer of peacetime missions from the Active to the Reserves should be included. Changes in personnel, training, and modernization policies may also affect the annual costs of Reserve personnel and units. Further work in these areas will complement and strengthen this analysis of annual operating and support cost and thereby enable better force-mix decisions in the future.

REFERENCES

1. Schank, John F., Susan J. Bodilly, and Richard Y. Pei, *Unit Cost Analysis: Annual Recurring Operating and Support Cost Methodology*, The Rand Corporation, R-3210-RA, May 1985.
2. Headquarters, United States Air Force, *USAF Cost and Planning Factors*, AFR 173-13, Washington, D.C., February 1982.
3. Department of the Army, *Army Force Planning Cost Handbook*, Office of the Comptroller, Army, Washington, D.C., November 1982.
4. Office of the Actuary, *Validation of the Military Retirement System, FY83*, Defense Manpower Data Center, Arlington, VA.

PRECEDING PAGE BLANK-NOT FILMED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER R-3210/1-RA	2. GOVT ACCESSION NO. ADA 167031	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Unit Cost Analysis: Executive Briefing	5. TYPE OF REPORT & PERIOD COVERED Interim	
6. AUTHOR(s) John Schank, Susan Bodilly, Richard Pei	7. CONTRACT OR GRANT NUMBER(s) MDA903-85-C-0030	
8. PERFORMING ORGANIZATION NAME AND ADDRESS The Rand Corporation 1700 Main Street Santa Monica, CA 90406	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
11. CONTROLLING OFFICE NAME AND ADDRESS Asst. Secretary of Defense (Reserve Affairs) Washington, DC 20301	12. REPORT DATE March 1986	13. NUMBER OF PAGES 27
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified	
	16a. DECLASSIFICATION/DEBRIEFING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release; Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) No Restrictions		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) COST ANALYSIS MILITARY FORCES(UNITED STATES) MILITARY RESERVES		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) see reverse side		

DD FORM 1 JAN 73 EDITION OF 1 NOV 68 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

This report documents an executive briefing of a methodology for estimating the annual operating and support costs for similar units in the Active and Reserve components of the military services, and the results of case studies to which the methodology was applied. The methodology was developed to acquire an initial understanding of the potential budget implications of force mix decisions. It estimates the annual recurring incremental costs of unit personnel, peacetime equipment operations and peacetime base support. The accuracy of the cost estimates depends on the quality of the available data, which varies across the services and the different categories of cost factors. While the costing methodology developed under this research provides the necessary tools to estimate the annual recurring costs of specific types of units, further analysis in the areas of non-recurring transition costs and the difference between average and marginal personnel and equipment costs for force mix changes will be needed to understand the full budget impact of force mix decisions.

END
DATE
FILMED
6-86